rial having elasticity and ductility. The material having elasticity and ductility may comprise rubber, polymer, paper, natural fiber and synthetic fiber. In the tactile and visual display device, the transistor connecting each of the corresponding pixels is driven to form rotating current, so that a magnetic force is generated and elasticity and viscosity are represented.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The above and other objects, features and advantages of the present invention will become more apparent to those of ordinary skill in the art by describing in detail exemplary embodiments thereof with reference to the attached drawings in which:

[0017] FIG. **1** is a perspective view of a tactile and visual display device according to an exemplary embodiment of the present invention;

[0018] FIG. **2***a* illustrates the configuration of a tactile sensation generator constituting a tactile and visual display device according to an exemplary embodiment of the present invention, and FIG. **2***b* illustrates the circuit configuration of the corresponding pixel illustrated in FIG. **2***a* according to an exemplary embodiment of the present invention;

[0019] FIG. **3** illustrates a sensor according to an exemplary embodiment of the present invention; and

[0020] FIG. **4** illustrates a sensor according to another exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF EMBODIMENTS

[0021] The present invention will now be described more fully hereinafter with reference to the accompanying drawings, in which exemplary embodiments of the invention are shown. This invention may, however, be embodied in different forms and should not be construed as limited to the exemplary embodiments set forth herein.

[0022] FIG. **1** is a perspective view illustrating the configuration of a tactile and visual display device according to an exemplary embodiment of the present invention, FIG. **2***a* illustrates a tactile sensation generator constituting the tactile and visual display device according to the present invention, and FIG. **2***b* illustrates the circuit configuration of a corresponding pixel illustrated in FIG. **2***a*.

[0023] Referring to FIGS. **1**, **2***a* and **2***b*, a tactile and visual display device **1** according to the present invention includes a display unit **100** formed on a substrate, a tactile sensation generator **200** mounted over the display unit **100** and generating an electrostatic force or a magnetostatic force according to a signal provided by the display unit **100**, and a sensor **300** sensing the electrostatic force or the magnetostatic force provided by the tactile sensation generator **200** to perceive tactile information. That is, the tactile sensation generator **200** is mounted over the display unit **100** and transmits light emitted from a display to provide a user with visual information, and transmits the electrostatic force or the magnetostatic force of the surface to the sensor **300**, so that a user can perceive tactile information. The sensor **300** is mounted over a user's finger and changes the tactile information generated from the tactile sensation generator **200** to a physical displacement to perceive the information by the user's touch.

[0024] Details of the components will be described below. First, the display unit **100** includes a plurality of scan lines **101**, a plurality of data lines **102** and a plurality of pixels **103**. The tactile sensation generator **200** includes a plurality of corresponding pixels **201** formed to correspond to the pixels **103**, and a plurality of field effect transistors (Tr_1 to Tr_{20}) **220** electrically connecting the adjacent corresponding pixels **201** to each other (Refer to FIG. **2***a*). The tactile sensation generator **200** connects the corresponding pixels **201** to the field effect transistors **220** and applies a gate voltage to certain field effect transistors in order to generate current of a shape desired by a user, so that an electric field or a magnetic field is generated. The field effect transistors **220** are separately formed from transistors constituting the corresponding pixels **201**. The corresponding pixels **201** of the tactile sensation generator **200** may be formed to be the same size as the pixels **103** of the display unit **100**. This is so that light generated from the display unit **100** can be transmitted without scattering.

[0025] The corresponding pixels **201** of the tactile sensation generator **200** are connected to each other using an active device such as a drive circuit used in an active-matrix device such as a liquid crystal display (LCD). More specifically, referring to FIG. **2**, each corresponding pixel **201** of the tactile sensation generator **200** is mounted over the display unit **100** and includes a transparent electrode **211** transmitting light emitted from the pixel **103**, a plurality of address lines **212** and a plurality of scan lines **213** electrically connected to the transparent electrode **211**, transistors **214** and **215** transmitting a signal applied to the address line according to a scan signal applied to the scan line **213**, a capacitor **217** storing a voltage corresponding to the transmitted signal, and a transistor **216** providing a current corresponding to the voltage stored in the capacitor **217** to the transparent electrode **211**. When the drive circuit driving the corresponding pixels **201** of the tactile sensation generator **200** has the above configuration, an active-driving circuit included in each of the corresponding pixels **201** can provide charge to each corresponding pixel **201**, so that a force may be generated by a phase difference with the sensor **300**.

[0026] FIG. **3** illustrates an enlarged pad portion **310** of a sensor according to an exemplary embodiment of the present invention, and FIG. **4** illustrates a sensor according to another exemplary embodiment of the present invention.

[0027] Referring to FIGS. **3** and **4**, the sensor **300** includes a pad portion **310** including a plurality of sensing pixels **311** corresponding to the corresponding pixels **201** of the tactile sensation generator **200**, and a pad connector **320** having one end electrically connected to the pad portion **310** and the other end electrically connected to the tactile sensation generator **200**. Referring to FIG. **3**, the pad portion **310** includes an insulated connecting line **312** connecting the plurality of sensing pixels **311** and the adjacent sensing pixels **311**. The insulated connecting line **312** is a component through which current cannot flow, is connected between the sensing pixels **311**, includes cotton, silk, rubber, synthetic fiber, etc., and may have various connection types rather than a line connection type. Particularly, the insulated connecting line **312** enables the sensing pixels **311** to freely move while their relative positions are maintained (within 2 mm—humans are insensitive to movement of 1 mm or less).

[0028] Each of the sensing pixels **311** of the pad portion **310** is formed of a conductive material to sense an electrical force, or of a magnetic material (including a permanent magnet) to sense a magnetic force. The reason why the sensing pixels **311** are connected to each other by the insulated connecting lines **312** is to insulate the adjacent sensing pixels **311** from each other. Meanwhile, referring to FIG. **4**, a plurality of